

# Watercourse Maintenance Guidelines

## Table of Contents

	<u>Page</u>
Introduction. . . . .	1
PURPOSE, CODES AND RESPONSIBILITIES . . . . .	1
Purpose . . . . .	1
Applicable Codes and Policies . . . . .	1
Maintenance Responsibilities . . . . .	2
Private maintenance activities	
Private involvement with publicly maintained watercourses	
Public drainage ways and public drainage easement	
Requirements for coordination	
 GUIDELINES	
Watercourse Structure . . . . .	5
Watercourse types . . . . .	6
Natural Watercourses	
Constructed Watercourses	
Sheet Flow Watercourses	
Maintenance Guidelines . . . . .	11
Floodwater conveyance needs and vegetation . . . . .	11
Maintenance Examples for Constructed Watercourses . . . . .	14
Vegetation Types . . . . .	15
Invasive and destructive species	
Problem or “Pest” species	
Beneficial species	
 FIGURES	
Figure 1. Typical watercourse structure . . . . .	5
Figure 2. Natural watercourse with typical watercourse structures identified. . . . .	6
Figure 3. Constructed watercourse with typical watercourse structures identified . . . . .	8
Figure 4. Schematic diagram of sheet flow watercourse structures . . . . .	9

Figure 5. Sheet flow watercourses with watercourse structures identified . . . 10

Maintenance Examples for Constructed Watercourses . . . 14

APPENDICES

Appendix A: Codes and Policies . . . 17

Appendix B: Plant directory . . . 18

Appendix C: Channel roughness images. . . 33

Appendix D: Herbicide use policy . . . 44

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# **WATERCOURSE MAINTENANCE GUIDELINES FOR WATERCOURSES WITHIN THE CITY OF TUCSON**

## **INTRODUCTION**

Watercourse in the City provide many beneficial functions such as flood water conveyance, local wildlife habitat as well as linkage to habitat along the watercourse and between watercourses, heat island mitigation, carbon sequestration in the vegetation, and green relief for social well being. In addition to the public benefits associated with watercourses are management issues such as fire management, mosquito breeding and harborage prevention, concealment of inappropriate behavior and public safety associated with floodwater conveyance. All of these issues combine to make watercourse maintenance a complex balancing act between benefits and liabilities.

Many entities are responsible for watercourse maintenance. In the past such maintenance has been at a minimum inconsistent to occasionally catastrophic resulting in the destruction of significant riparian habitat resources, all due to the lack of defined procedures and intent. The Watercourse Maintenance Guidance Manual has been developed to provide maintenance direction and explain the maintenance intent.

## **PURPOSE, CODES AND RESPONSIBILITIES**

### **PURPOSE**

The Watercourse Maintenance Guidelines (WMG) ensure that watercourse maintenance: 1) preserves floodwater conveyance, 2) meets public safety needs, 3) minimizes mosquito breeding and harborage, 4) minimizes fire hazards 5) maximized visibility for security, and 6) conforms to existing riparian habitat preservation Codes, Standards and Policies. These guidelines apply to property owners, contractors, neighborhood groups, City Departments and other jurisdictions conducting watercourse maintenance activities within Tucson city limits.

### **APPLICABLE CODES AND POLICIES**

The Tucson Code sections listed below regulate man-made changes to watercourses within the City of Tucson corporate limits:

- Tucson Code, Chapter 26, Sections 26-1 to 26-16, Floodplain and Erosion Hazard Management Regulations
- Tucson Code, Chapter 29, Article VIII, Sec. 29-12 to 29- 19, Watercourse Amenities, Safety and Habitat (WASH) Regulations
- Tucson Code, Chapter 23, Land Use Code (*LUC*), Article II, Division 8, Sec. 2.8.6, *et seq.*, Environmental Resource Zone (ERZ)

In addition to the code requirements listed above, the city of Tucson Mayor and Council adopted Development Standard (DS) 9-06.0, the Floodplain, WASH and Environmental Resource Zone Standard, in November 2006. DS No 9-06 provided a single, defined regulatory structure for the

consistent application of the Floodplain Regulations, ERZ and WASH regulations as applied to watercourse safety and riparian habitat issues. DS 9-06 applies to development that is located on private property.

The WMG achieves a balance between flood control, erosion considerations, vector management, and vegetation and wildlife habitat preservation. However, flood control considerations are the first priority in drainage maintenance; and, when flood control experts deem necessary, flood control maintenance will supercede other considerations. The WMG provides a general overview of watercourse maintenance activities but it does not address specific elements such as cost, budge, and funding sources, nor does it address the type, need and frequency of watercourse-specific maintenance on individual reaches of watercourses.

Private property owners (including individual property owners, contractors, neighborhood groups, homeowner associations, trusts, or corporations) may need to obtain permits, reviews and/or other approvals prior to undertaking watercourse maintenance, including, but not limited to, the following:

- City of Tucson Floodplain Use Permit
- City of Tucson Development Services Department (DSD) approval
- Office of Conservation and Sustainable Development approval
- City of Tucson WASH and ERZ watercourse code compliance
- Stormwater Advisory Committee (SAC) review
- Neighborhood, Specific and Area Plan compliance
- US Clean Water Act (CWA) Section 404 Permit

The individual or entity performing the watercourse maintenance is responsible of compliance with the requirements listed above. Each section of a watercourse has unique features that may require specific or even unique maintenance approaches. Contact the Office of Conservation and Sustainable Development (“Conservation Office”) for assistance in determining appropriate maintenance activities and applicable responsibilities.

For “routine maintenance” of watercourses, private property owners and entities may rely entirely on the WMG. “Routine maintenance” includes removal of invasive nonnative shrubs and grasses, removal of trash, and tree trimming conducted AS NEEDED to maintain water flow conveyance capacity on those watercourses where flow conveyance is limited. If you have any doubt whether routine trimming is needed to maintain water flow conveyance then contact the Conservation Office for additional guidance.

The City requires preapproval and/or permits if you intend to engage in activities beyond the scope of routine maintenance such as new construction, realignments, removal of “mature trees” (greater than 4” caliper), grading or other development activities. If you have any doubt whether your proposed maintenance goes beyond the limits of “routine maintenance,” then **prior** to any disturbance of the watercourse contact the Conservation Office to determine if approvals or permits are required. The Conservation Office will also determine whether the requirements of DS 90-06.0 apply.

## **MAINTENANCE RESPONSIBILITIES**

### **Private property maintenance activities**

The property owner (meaning individual property owners, contractors, neighborhood groups, homeowners associations, trusts, or corporations) is the responsibility of the maintenance of watercourse on private property and is subject to all applicable code and development standard requirements. Property owners and/or their maintenance contractor should use the WMG for guidance on maintenance activities in a watercourse. On privately maintained watercourses, maintenance activities that would require major expenditures and efforts beyond the scope. However, when watercourse maintenance activities on private property require major expenditures and efforts beyond the scope of "routine" maintenance the private property owner must consult with the Conservation Office and the Development Services Department to determine if permits, approvals, and professional assistance (i.e. construction plans prepared by a registered professional) are required.

The private property owner should be aware that under the Land Use Code, Platted Natural Undisturbed Open Space (NUOS), Native Plant Preservation Ordinance (NPPO) set aside areas, and areas zoned as Open Space (OS) have non-disturbance requirements. Routine maintenance is typically **not** allowed in these areas unless specified in the preservation specifications for that site. Occasional maintenance may be needed to trim and/or remove invasive nonnative grasses that pose fire hazards, removal or relocation of fallen trees that obstruct watercourse flows, and removal of debris from illegal dumping or other unauthorized activities. Maintenance in NUOS, NPPO set aside areas, and OS areas must be coordinated with the Conservation Office. In addition, prior to cleanup, the responsible party must send a letter to the City of Tucson Zoning Administrator that includes a map detailing the proposed cleanup area. The Zoning Administrator has the Development Services Department landscape section review the proposed work and send a landscape inspector to the site to ensure the work is done consistent with preservation requirements for designated NUOS, NPPO set aside areas or Open Space areas.

### **Private involvement with publicly maintained watercourses**

Trees for Tucson manages the Adopt-A-Wash program which allows neighborhood residents to participate in the cleanup and management of a watercourse in their area. In a cooperative effort, the Streets Division, the conservation Office, and the neighborhood set up a maintenance program for an Adopt-A-Wash section of a watercourse. The maintenance program prioritizing public safety and channel conveyance continue to be priorities if these are issues for the watercourse in question. Setting up a maintenance program for an Adopt-A-Wash reach of a wash is a cooperative effort between the Streets Division, the Conservation Office and the neighborhood. This team effort increases watercourse maintenance efficiency and watercourse safety because of the watchful eyes and periodic presence of neighborhood stewards. To participate in the program, contact Trees for Tucson.

### **Public drainage ways and public drainage easement**

In general, the City is responsible for maintenance of watercourses in **public** drainage rights-of-way and **public** drainage easements: however, the express language of the easement may allocate

the responsibility to a private party or entity. The Tucson Department of Transportation, Streets and Traffic Maintenance Division (“Streets Division”) manage and perform city maintenance activities in watercourses. Prior to starting maintenance activities the Streets Division, with the assistance of the Conservation Office, will determine the appropriate application of WMG to individual watercourse reaches.

Prior to scheduling recommended maintenance activities for a specific segment of a publicly maintained watercourse, the Streets Division will determine if any record of controversy regarding maintenance exists for that watercourse reach. If a maintenance controversy has been identified, the Streets Division will work with the appropriate Ward Office(s), the Conservation Office and concerned citizen(s) to address the proposed maintenance activities. Streets division may also seek citizen participation when the public has a significant concern about a specific maintenance activity.

The Streets Division must contact the appropriate Ward Office(s) a minimum of 5 days prior to starting any maintenance work for a specific reach of watercourse in that ward area. The Streets Division does not need to follow the 5-day notification procedure when emergency repairs are required; however, the Streets Division should call the appropriate Ward to inform them that an emergency repair event has occurred.

On publicly maintained watercourses, maintenance activities that require major expenditures and efforts beyond the scope of "routine" maintenance must be referred to the Engineering Division for inclusion in the Capital or Spot Improvement Program. The Streets Division determines when a construction project is not “routine maintenance” and referral is necessary. The Streets Division should take interim measures to protect watercourse integrity until the final design is constructed.

### **Requirements for coordination**

In some cases appropriate application of the WMG may require additional expertise. If there is a doubt as to application of the WMG, the Conservation Office will coordinate with other City Departments to determine appropriate watercourse maintenance as follows:

- Transportation Department - Engineering Division - Provide technical expertise regarding hydrologic and hydraulic watercourse characteristics including needed conveyance capacity, floodplain impacts, erosion control and other engineering-related issues. Provide designs of drainage facilities, as requested by the Streets Division, for field construction.
- Parks & Recreation Department - Provide expertise regarding all aspects of horticultural maintenance and trails. Parks may provide resources/ manpower to perform tree-pruning activities.
- Planning Department - Provide expertise related to contact with and input from the public, neighborhood concerns, Neighborhood plans and Area plans.

- Tucson Police Department – Provide expertise relative to public safety issues occurring in specific watercourse reaches and the implications of this for watercourse maintenance.
- Tucson Fire Department – Provide expertise regarding fire threats due to the presence of fire-prone nonnative invasive plants and the implications of this for watercourse maintenance.

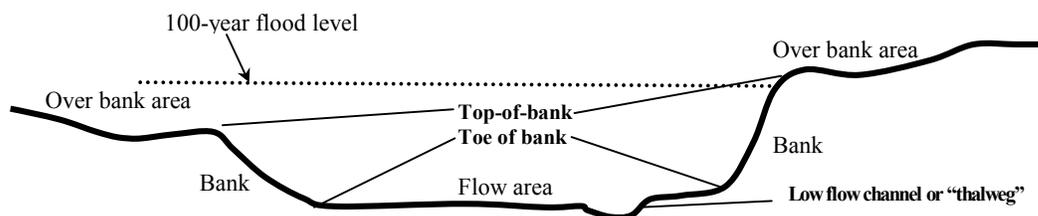
## GUIDELINES

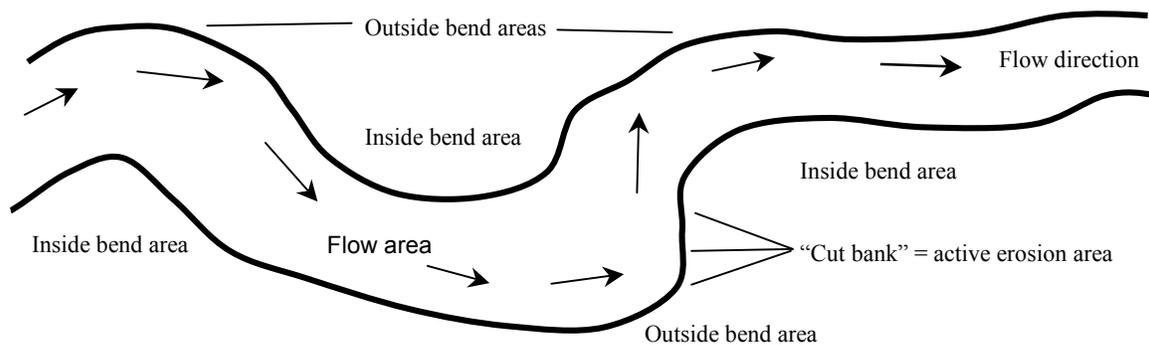
### TYPICAL WATERCOURSE STRUCTURE

Watercourses have three basic parts or structures with distinct characteristics, as described and illustrated below (Figure 1):

1. The **flow area**, also known as the channel bed, is the area at the bottom of the wash found between the bottom (“toe”) of each bank. Both small and large flow events affect this part of the wash by wetting the channel bed, moving sediment and impacting plant growth.
2. The **banks** of the watercourse are the areas above the channel bottom, between the toe-of-bank and top-of-bank on each side of the channel. The banks are wetted only in moderate- and high-flow events and may be subject to erosion during these events. Banks can also erode during low-flow events if they cut into the toe-of-bank causing overlying material to collapse into the wash. The slopes of banks can vary from very gentle to vertical and undercut, depending on the natural and engineered characteristics of washes. Banks are typically earthen except where banks have been stabilized with concrete or other materials.
3. The **over bank areas** are above and/or outside each top-of-bank. In natural systems, over bank areas receive flow during large flood events. In constructed watercourses, over bank flooding sometimes no longer occurs.

**Figure 1. Typical watercourse structure.**





## TYPES OF WATERCOURSES

The three typical watercourse structures described above are found on both natural watercourses that have a defined channel and on artificially constructed watercourses. Sheet flow watercourses are a variation of natural watercourses that have two watercourse structures rather than three. Natural, constructed and sheet flow watercourses are described and illustrated below.

### **Natural Watercourses**

A “natural watercourse” is one that is naturally vegetated and minimally altered or completely unaltered by urbanization, with roadway and utility crossings being the only major impacts. Figures 2a and 2b show a typical natural watercourse in Tucson with watercourse structures labeled. When left undisturbed, a natural watercourse should remain in its natural condition without significant changes in vegetation density or diversity over time. Most natural watercourses have few invasive or “pest” plant species. These watercourses are typically found at the outer edges of the City. Natural watercourses are assumed to be in or near a state of dynamic equilibrium with regard to their shape and form and the diversity and density of native plants found there. They typically have native vegetation, wildlife habitat and open space values. **Maintenance needs are minimal on natural watercourses**, but as the watersheds of natural watercourses are developed, the dynamic equilibrium of the watercourses may shift due to changes in sediment supply resulting from paving and landscaping. Changes in maintenance needs, usually associated with erosion, will be one of the first signs of a need for more active management of a natural watercourse.

**Figure 2a and 2b. Natural watercourse with typical watercourse structures identified.** Top figure is looking upstream. Bottom figure is looking at the watercourse from overhead.

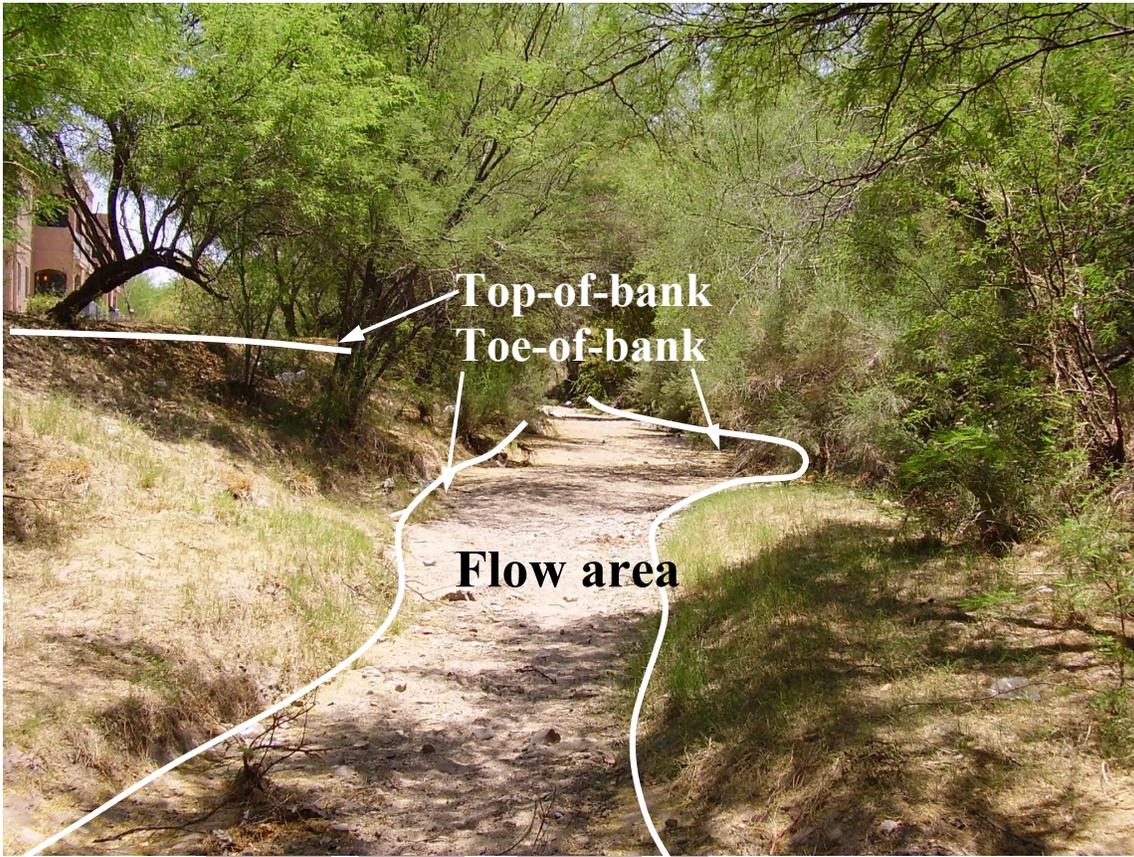


Figure 2a



Figure 2b

## Constructed Watercourses

A "constructed watercourse" is one that has been partially or completely modified through channelization, channel relocation, channel realignment and/or bank stabilization. Figure 3 shows a typical constructed watercourse in Tucson with watercourse structures labeled. A constructed watercourse can range from an artificially shaped earthen channel with native vegetation present, to a relocated concrete-lined channel with little vegetation. The vast majority of watercourses in central Tucson are constructed watercourses with degrading earthen channel, which **require on-going maintenance**. Constructed watercourses with full bank protection usually require minimal maintenance. Maintenance of constructed watercourse helps ensure continued safe and effective floodwater conveyance while retaining any remaining values of the watercourse including riparian habitat, open-space, heat island mitigation and passive recreation.

**Figures 3a and 3b. Constructed watercourse with typical watercourse structures identified.** Top figure is looking upstream. Bottom figure is looking at the watercourse from overhead.

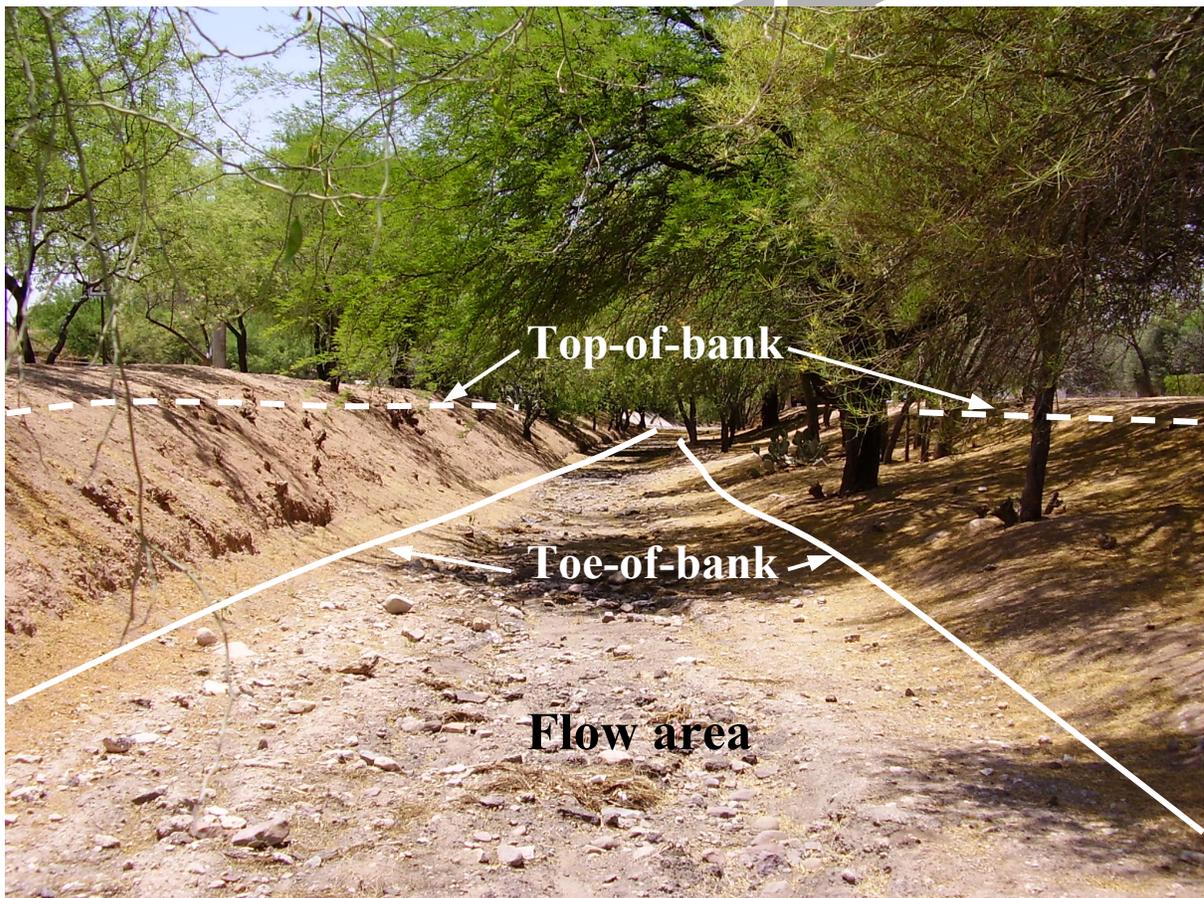


Figure 3a

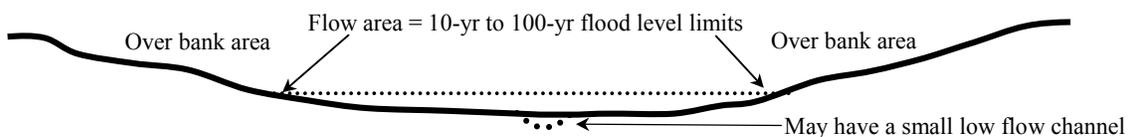


Figure 3b

### Sheet Flow Watercourses

Water flows broadly across the landscape in sheet flow watercourses. Sheet flow watercourses have no banks or poorly defined banks, so consist of the **flow area** and the adjacent **over bank area**. Figure 4 shows a schematic cross section of a sheet flow watercourse with structures identified. Figure 5a, b, and c shows a typical sheet flow watercourse with these same watercourse structures labeled. The flow area is often defined by the lateral limits of denser vegetation, often located at the 10-yr to 100-yr floodplain boundary, with grasses and more widely spaced trees within the flow area. The flow area may be several hundred feet wide. Most sheet flow watercourses that were in the developed portions of the City were channelized to accommodate development. The vast majority of the remaining sheet flow watercourses are natural watercourses located on the periphery of the City. Maintaining the sheet flow character of these watercourses is critical to watershed hydrology, watercourse stability and associated riparian habitat stability. Monitoring and preventing channel entrenchment is critical.

**Figure 4. Schematic diagram of sheet flow watercourse structures**



**Figure 5a, 5b and 5c. Sheet flow watercourses with watercourse structures identified.** Top figures show two views from overhead--note the broad width of the flow areas. Bottom figure shows view looking downstream--note the lack of a bank.

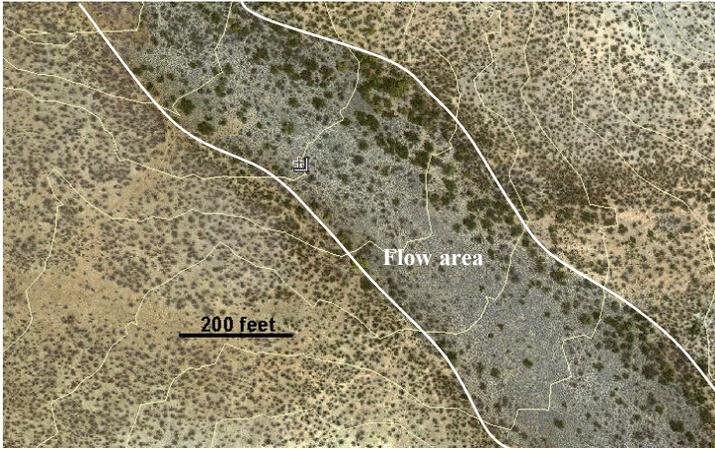


Figure 5a

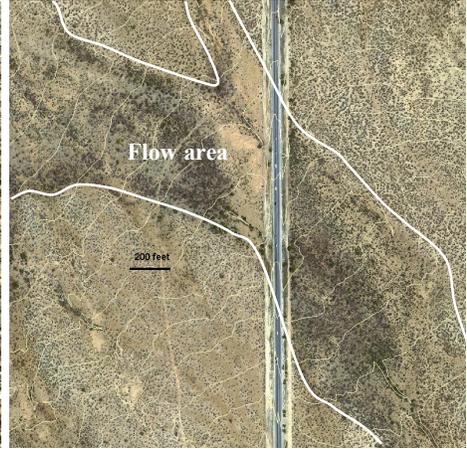


Figure 5b



Figure 5c

## MAINTENANCE GUIDELINES

It is in the nature of healthy riparian systems for native plants to self-seed and grow. Their ultimate size will depend on the volume of water that periodically flows down the watercourse and saturates the soils. A healthy equilibrium is reached between the number, size, and diversity of plants, and the average water availability over time. Whenever possible, this natural process should be allowed to take place without interference in the form of trimming, plant removal, earth moving, and other disturbances. However, there are circumstances that “break” these natural systems, resulting in active maintenance being needed. The guidelines in Table 1 are intended to direct City staff and others in the maintenance of constructed watercourses and natural watercourses (including sheet flow watercourses). In all cases where vegetation or watercourse structure will be altered, the Conservation Office should be consulted prior to detailed planning and ground-based activity, to determine if watercourse protection requirements affect the subject site.

### Floodwater conveyance needs and vegetation

**Conveyance capacity** is the size of flood flow a watercourse can hold within its banks. Some watercourses do not have sufficient conveyance capacity to contain large flows. The responsible entity must maintain the vegetation in the watercourse because overgrowth of vegetation can reduce the conveyance capacity of floodwater in a channel, which creates a potential for increased flooding and erosion damage to adjacent property. The maintenance must be conducted in a manner that limits damage potential to a level at or below the long-term predevelopment condition of the watercourse reach, or at or below the flood levels established by floodplain study modeling such as Flood Insurance Studies (FIS), City flood hazard zone studies, and studies completed for adjacent developments. One key term in calculating the conveyance capacity of a watercourse is called the “channel roughness coefficient” or simply the channel roughness. Channel roughness is a numeric value used to estimate of the resistance to flow caused by sand, rocks, vegetation, channel geometry and sinuosity and other materials present in a channel. The higher the number the more resistance to flow there is and the slower the floodwaters move through the channel, so channel roughness has a direct impact on the conveyance capacity of a wash. At the same time, the slower the water flows, the less dirt erodes and the more water infiltrates into the ground to support the habitat. So it is important to not over-trim a watercourse.

Many watercourses have mapped floodplain boundaries that are outside the watercourse channel. Maintaining the watercourse to the mapped floodplains modeling parameters is important to prevent increased flooding. When maintaining a watercourse that has a mapped floodplain matching the channel roughness is important.

**Appendix C** contains images of watercourses with associated channel roughness values. The roughness value for the wash you propose to maintain is available at <http://tdotmaps.transview.org/StormwaterMap/StormwaterPublicMap.cfm>. Check this website to find out the roughness number, then select the corresponding picture in Appendix c. This is theoretically the degree of trimming needed for that wash to maintain flood flows. HOWEVER, you must meet with the Conservation Office well before you plan to maintain the watercourse, if

the level of trimming that appears to be needed would moderately or greatly reduce the amount of vegetation growing in the watercourse.

**Ground cover** vegetation is important to many species. Ground cover vegetation is usually flexibly in the presence of floodwaters and thus should not be indiscriminately removed. Monitor and trim as necessary the stiff-upright ground cover that may catch debris and present flow blockage. Otherwise leave ground cover as is.

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**Table 1. Maintenance Guidelines for Watercourse**

<b>MAINTENANCE ACTIONS</b>		<b>Constructed channel with conveyance problems</b>	<b>Constructed channel, no conveyance problems</b>	<b>Natural watercourse (including sheet flow), no conveyance problems</b>
<p><b>TREE REMOVAL</b> (Flow area only): Remove trees and shrubs in the flow area to eliminate possible obstructions that would slow flows, divert flow or inhibit maintenance use and access. For wide channels with excess capacity, some trees can remain in the flow area. Any modifications that disturb vegetation or watercourse structure requires Conservation Office review and approval prior to any modifications.</p>		APPLIES	DOES NOT APPLY	DOES NOT APPLY
<p><b>TREE*, SHRUB &amp; GRASS TRIMMING</b> ( All areas): Cutting or trimming trees, shrubs, and grasses should occur only when needed to eliminate a hazard to public safety and health. Trimming should occur only when vegetation density could impede overbank flow conveyance or significantly obstructs visibility into the watercourse. Tree trimming should not exceed four feet above the ground. Naturally occurring tree and plant litter, such as small branches and leaves, should be left on the ground on the watercourse banks and over bank areas in order to provide a more natural appearance and to promote wildlife habitat value. Standing dead trees and large limbs may be removed whenever there is concern that the tree or limb may fall on nearby structures, pose a public-safety hazard, or may fall into the watercourse causing a reduction/obstruction of floodwater conveyance. Whenever maintenance of grasses is warranted, grass should be mowed rather than removed or bladed. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>		Only if immediate concern for public safety, health, and welfare. Consult with the Conservation Office	Only if immediate concern for public safety, health, and welfare. Consult with the Conservation Office	Only if immediate concern for public safety, health, and welfare. Consult with the Conservation Office
<p><b>WORK IN MEANDERING STREAMS</b> (flow area and banks): Apply the following cautions to the <i>outside bend</i>: leave ground-cover plants and grasses in place (if acceptable for conveyance needs). In flow area, leave trees in place, but trim low branches from multi-trunk trees and branched trees. Apply the following additional cautions to the <i>inside bend</i>: remove built up sediment as needed to maintain conveyance, if needed. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>		APPLIES		Intervene only if immediate concern for public safety, health, and welfare. Consult with the Conservation Office
<p><b>PLANT LITTER MANAGEMENT</b> (Bank area &amp; overbank area): Leave dead trees and plant litter in place as soil-nutrients, wildlife cover, erosion control, seed-sources and to maintain a natural appearance unless plant litter could potentially obstruct or divert storm runoff that may cause damages.</p>		APPLIES		APPLIES
<p><b>ALLOW NATIVE PLANT RECRUITMENT</b> (all areas): Allow native plants and seeds to become established, especially in replacement of nonnative invasive plants.</p>		APPLIES		APPLIES, but inspect
<p><b>INVASIVE PLANT MANAGEMENT</b> (all watercourse areas): Routinely remove nonnative invasive plant species listed in Section XXX. Remove pest plant species listed in Section X+X only if replacement planting with native species will occur.</p>		APPLIES		APPLIES

**MAINTENANCE ACTIONS**

	Constructed channel with conveyance problems	Constructed channel, no conveyance problems	Natural watercourse (including sheet flow), no conveyance problems
<p><b>RESTORATION SEEDING AND PLANTING</b> (Bank area &amp; overbank areas): Conduct restoration planting and seeding to replace and enhance plant density in watercourses where nonnative plants have been removed, excessive trimming or tree removal has occurred, native plants have decreased due to historic grazing or other degradational activities. Consult with the Conservation Office about restoration planning.</p>	APPLIES		APPLIES
<p><b>CHANNEL GRADING</b> (Flow area): Grade or level the channel bottom to maintain floodwater conveyance (see Appendix C for list of applicable watercourses). Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>	APPLIES		NO
<p><b>CHANNEL MODIFICATIONS</b> (Flow area &amp; bank area): May make minor structural modifications to the shape and alignment of the flow area to maintain existing floodwater conveyance and/or minimize possible flood damage to nearby structures. Design of modifications must minimize environmental/ecological impacts to the affected area. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>	APPLIES		Applies only if immediate concern for public safety, health, and welfare. Consult with the Conservation Office
<p><b>STRUCTURAL REPAIR</b> (Flow area &amp; bank area): Repair existing stormwater conveyance structures (e.g. culverts, storm drains, spillways) and bank protection (e.g. gabions, rip-rap, soil cement) as needed to prevent or minimize further damage. Modifications should be carefully designed by an engineering entity or other responsible qualified entity in order to maintain the existing aesthetics, environmental quality, and long-term stability of stream migration both laterally and vertically. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>	APPLIES		APPLIES
<p><b>MAINTENANCE ACCESS RAMPS</b> (flow area &amp; bank area): Construct roads and ramps into watercourses only when necessary. Design them to minimize impacts to vegetation and other natural features. When possible place roads/ramps on the inside of the channel bend with sloped pointed downstream. Where roads/ramps are being removed, minimize impacts to vegetation or other natural features during removal. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>	APPLIES		APPLIES
<p><b>SCOUR HOLE MAINTENANCE</b> (Flow area): Level and fill scour holes to maintain level channel bottom. Do not import dirt that contains seeds from nonnative invasive plant species. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>	APPLIES		ONLY if an adjacent drainage structure might be impacted or mosquito

**MAINTENANCE ACTIONS**

	Constructed channel with conveyance problems	Constructed channel, no conveyance problems	Natural watercourse (including sheet flow), no conveyance problems
			propagation might occur (ponding for more than <b>36</b> hours).
<p><b>EROSION CONTROL</b> (bank area &amp; overbank area): Fill areas of rilling, piping, and other forms of erosion when erosion presents a hazard to channel stability or adjacent properties. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>	APPLIES		Do not control erosion unless it is progressing beyond top-of-bank and over bank area. Consult the Conservation Office before proceeding.
<p><b>SECURITY NEEDS</b> (all areas): If threats to public health, safety and welfare exist in the area of the watercourse due to the presence of dense vegetation, then trimming of trees, shrubs and grasses may occur regardless of watercourse type. A request from the City Police or Fire Department may trigger trimming, or trimming may be triggered by neighborhood concerns. Low branches, should be removed from existing neighborhood paths and adjoining alleys to permit safe access, insure visibility, and surveillance. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>	APPLIES		APPLIES
<p><b>DETER TRESSPASSING</b> (all watercourse areas): Install permanent barricades, fences or appropriate signs to deter trespassing, unwanted vehicular access, wildlife dumping, and other unwanted activities. Installation of devices in the floodplain requires coordination with the Engineering division. Any modifications that disturb vegetation or watercourse structure require Conservation Office review and approval prior to any modifications.</p>	APPLIES		APPLIES
<p><b>TRASH PICK UP</b> (all watercourse areas): Routinely remove and properly dispose of all trash and other discarded debris such as construction materials, yard clippings, shopping carts, etc., from all watercourse areas.</p>	APPLIES		APPLIES
<p><b>MOSQUITO ABATEMENT</b> (flow area): Apply BTI to areas of standing water as first step. If that does not abate mosquito threat, fill holes that hold standing water for more than <b>36</b> hours. If reducing harborage of adult mosquitoes is needed, cut grass in harborage areas but do not remove grass by roots, or blade the area, unless the grass is nonnative and invasive, such as buffelgrass (see section XX for invasive plant</p>	APPLIES		APPLIES

**MAINTENANCE ACTIONS**

	Constructed channel with conveyance problems	Constructed channel, no conveyance problems	Natural watercourse (including sheet flow), no conveyance problems
species). Trim trees to four feet above the bank and over bank area to help address harborage of adult mosquitoes.			

- **NOTE:** trimming more than 1/3 of the tree canopy volume will put the tree at risk of dying, especially for seedlings (varies by species).
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## MAINTENANCE EXAMPLES FOR CONSTRUCTED WATERCOURSES



1. Close!! Needs a little lower limb trimming. Can tolerate a little more ground cover.



2. Tree canopies need a little lower limb trimming. Banks too clean, allow development of ground cover.



3. TOO CLEAN!! Lacks ground cover. Has lost of habitat and is susceptible to bank erosion.



4a. Watercourse maintenance before.



4 b. Watercourse maintenance after.

The watercourse reach should have this maintained long before this much debris accumulated.

## VEGETATION TYPES

### **Invasive and destructive species**

The following plant species should be removed in all cases. These species have moderate to severe impacts on ecosystems, plant and animal communities and vegetative structure. Trimming or mowing of these species is not sufficient to prevent re-growth and negative impacts, so plants must be removed including roots or killed by chemical treatment. Systemic herbicide treatment using non-polluting EPA-approved chemicals such as Rodeo is acceptable. Read all manufacturers guidance on the appropriate use of these materials.

- Buffelgrass – *Pennisetum ciliare*
- Cane (bamboo) – all species
- Fountain grass (green) – *Pennisetum setaceum cupreum*
- Johnson grass – *Sorghum halepense*
- Sahara mustard – *Brassica tournefortii*

### **Problem or “Pest” species**

Several nonnative species prolifically self-seed, clogging channels, reducing the conveyance capacity of washes and displacing native vegetation. These species are as follows:

- Argentinean mesquite – *Prosopis alba*, var *colorado*, and other mesquites of South American origin (NOTE: native velvet mesquite – *prosopis velutina*, and Texas Honey Mesquites – *prosopis glandulosa*, should NOT be removed. Ensure that correct species identification has been made BEFORE removing any mesquite trees)
- African sumac - *Rhus lancea*
- Deciduous Tamarisk (salt cedar) - *Tamarix ramosissima* and *Tamarix parviflora*
- Desert Broom – *Baccharis sarothroides*
- Mexican Palo Verde – *Parkinsonia (Cercidium) aculeata*

Although desert broom – *Baccharis sarothroides* is a native shrub it is considered a pest by some because of its thick stature and ability to self-seed in disturbed soils and along washes. In addition, it releases pollen in the spring that some people have allergies to and produces a thick cloud of airborne seeds in the fall. The criteria listed below for nonnative species can be applied to this species as well, also in consultation with the Conservation Office.

While these “pest” plants can create problems, in the absence of a healthy native plant population these species might provide beneficial functions such as stabilizing soil, providing cover for birds and other wildlife, and providing shade that reduces the urban heat island effects. The decision as to whether to remove these nonnative plants should be made based on some or all of the following criteria, in consultation with the Conservation Office:

- Plant is located within the channel in a watercourse that needs to be periodically trimmed due to limited conveyance capacity
- Diameter of the plant’s trunk is less than 2~~X~~ inches
- Plant is not located in an area that is actively eroding or could potentially begin to erode if the plant is removed
- There will be replacement planting or the area has sufficient numbers of native plant seedlings to naturally replace the removed plants.

### Beneficial species

The native tree and shrub species listed below should be preserved **in-place to the greatest extent possible**. Maintenance modifications should be limited to trimming of low hanging or dead branches. Removal should only take place when the plant presents a safety hazard due to a serious threat to adjacent infrastructure, property or watercourse conveyance needs. Some plants rare, as noted in parenthesis) meaning they are currently found only in isolated locations within the City of Tucson, primarily due to the decline of water levels along watercourses over the last century.

Arizona (Velvet) Ash (rare) – *Fraxinus velutina*  
Arizona Sycamore (rare) – *Platanus wrightii*  
Arizona Walnut (rare) – *Juglans major*  
Blue Palo Verde – *Parkinsonia (Cercidium) floridum*  
Catclaw acacia – *Acacia greggii*  
Desert Willow – *Chilopsis linearis*  
Desrt Hackberry – *Celtis pallida*  
Foothills palo verde – *Parkinsonia microphyllum*  
Freemont Cottonwood (rare) – *Populus fremontii*  
Gooddings willow (rare) – *Salix gooddingi*  
Ironwood Tree – *Olneya tesota*  
Mexican elderberry (rare) – *Sambucus mexicana*, (*Sambucus caerulea* var. *mexicana*)  
Netleaf hackberry (rare) – canyon hackberry; *Celtis reticulata*  
Screwbean Mesquite (rare) – *Prosopis pubescens*  
Seep willow – *Baccharis salicifolia*  
Texas Honey Mesquite – *Prosopis juliflora* var *glandulosa*  
Tree Tobacco – *Nicotiana glauca*  
Velvet mesquite – *Prosopis velutina*

Western Soap Berry (rare) – *Sapindus drummondii*  
Whitethorn acacia – *Acacia constricta*

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## **ATTACHMENT A: CODES AND POLICIES REGULATING DISTURBANCE OF RIPARIAN HABITATS**

All development (any man-made change) in riparian habitat areas along the watercourses within the Tucson corporate limits is regulated. Using the authority granted the City by the Floodplain and Erosion Hazard Management Regulations, the City has combined the regulations for all three of the following codes into one document, Development Standard 9-06.0.

Development Standard 9-06.0 may be viewed on the WEB at:  
[http://www.tucsonaz.gov/dsd/Codes\\_\\_\\_Ordinances/DevStdTOC9.pdf](http://www.tucsonaz.gov/dsd/Codes___Ordinances/DevStdTOC9.pdf)

Tucson Code, Chapter 26, Floodplain and Erosion Hazard Management Regulations, Sections 26-5.1.4 and 26-5.2.4

This Code may be viewed on the WEB at:  
<http://www.municode.com/resources/gateway.asp?pid=11294&sid=3>

Tucson Code, Chapter 29, Article VIII, sections 29-12 to 29- 19, Watercourse Amenities, Safety and Habitat (WASH) Regulations

This Code may be viewed on the WEB at:  
<http://www.municode.com/resources/gateway.asp?pid=11294&sid=3>

Tucson Code, Chapter 23, Land Use Code (*LUC*), Article II, Division 8, Section 2.8.6, Environmental Resource Zone (ERZ)

This Code may be viewed on the WEB at:  
[http://www.tucsonaz.gov/planning/codes/luc/lucweb/Art2div8.html#P1424\\_85473](http://www.tucsonaz.gov/planning/codes/luc/lucweb/Art2div8.html#P1424_85473)

## APPENDIX B: PLANT DIRECTORY

### INVASIVE AND DESTRUCTIVE SPECIES

#### **Buffel grass – *Pennisetum ciliare***

Buffelgrass is a shrubby grass to 1.5 feet tall and 3 feet wide. It looks like a bunchgrass when small (either a seedling or recently burned, grazed, or cut). Older plants branch profusely and densely at nodes (joints) in the leaf stalk, giving mature plants a messy appearance. **Must be removed by the roots.**

**Key features:** grows in bunches, often with a reddish tinge to leaves and seed, nodes (joints) in the leaf stalk



#### **Fountain grass (green) – *Pennisetum setaceum cupreum***

Fountain grass grows in dense, symmetrical clumps that can get 3-4 ft tall and 2-3 ft across with a fountain of feathery plumes flowing out of the foliage. Fountain grass makes large monocultures (*monoculture: a crop or a population of a single kind of organism grown on land*), which prevent other plant species from growing within those monocultures. This grass spreads quickly and will carry fire. **Must be removed by the roots**

**Key features:** long, bright green leaves, grows in bunches, leaves thinner and longer than Buffel grass, **no nodes** (joints) in leaf stalks,



#### **Cane (bamboo) all species**

Bamboo is just grass, but it varies in height from dwarf, one foot plants to giant timber bamboos that can grow to over 100 feet. Bamboo grows by two style, by clumping and by runners. Runner varieties of bamboo tend to be the invasive types that spread quickly.

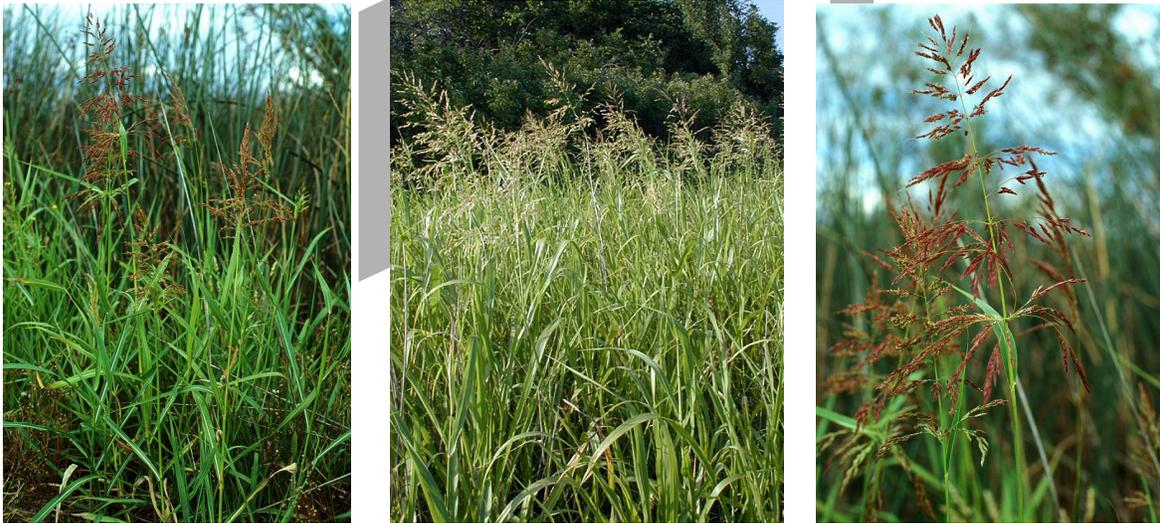
**Key features:** segmented hollow stalk, grows in bunches, leaves or branches at segment boundaries



**Johnson grass (*Sorghum halepense*)**

Johnson grass is considered one of the 10 most noxious weeds in the world. A perennial plant with vigorous rhizomes (root system) that can rapidly develop colonies. Must be removed by the roots.

**Key features:** Tall grass commonly 5 to 6 feet tall, nodes (joints) in the leaf stalk, leaves up to 1" wide



Sahara mustard – *Brassica tournefortii*

Sahara mustard (*Brassica tournefortii*) AKA Asian mustard is an annual herb with stems four to forty inches tall. Plants flower early, but the flowers are small and dull yellow, making them inconspicuous compared to most other true mustards. Petals are less than one-quarter inch. Individual flower stalks are longer than the sepals and spread away from the stem.

**Key features:** looks somewhat like a large cluster of dandelion plants with spikes on top, plant can detach and be moved by the wind like a tumbleweed,



## **Problem or “Pest” species**

### **Argentinean Mesquite – *Prosopis alba*, var *Colorado***

Upright, vase-shaped tree with broad canopy, 20-40ft, spread usually 2/3 height, thorns usually present, sometimes strongly, usually large (1 in to 6 in) thorns in zig-zag form; dark rough bark

**Key features:** Commonly has long thorns, smooth bark when young, many leaflettes per



### **African sumac - *Rhus lancea***

African sumac is a small to medium sized evergreen tree, up to 24 feet tall , 24 feet spread or more; dark gray or brown, coarse bark, showing **orange under layer**; hairless compound leaves with three lance-shaped leaflets, 2 to 4 inches long. Pollen is allergenic

**Key features:** long leaves, dark brown to black bark, orange brown color under the bark. Small round seeds that look like peppercorns.



### **Tamarisk (salt cedar) - *Tamarix* sp.**

Tamarisks are characterized by slender branches and grey-green foliage. The bark of young branches is smooth and reddish-brown. As the plants age, the bark becomes brownish-purple, ridged and furrowed. The leaves are scale-like, 0.04 to 0.08 inches long, and overlap each other along the stem. The pink to white flowers appear in dense masses on 2 to 3 inch long spikes at branch tips from March to September.

**Key features:** long grey-green “needles” with scaly leaves. Soft appearance from a distance.



### **Desert Broom – *Baccharis sarothroides***

Desert broom is a vertical, evergreen, densely-branched shrub usually 3 to 6 feet tall, occasionally to 10 feet. The many fine twigs are green; the tiny, linear leaves are deciduous during dry periods. The plants are dioecious (that is, each individual plant bears only “male” or “female” flowers) and blooms in the fall. The wind-dispersed, white-tasseled seeds are produced by the female plants in such abundance that the plants and nearby ground appear to be snow-covered.

**Key features:** long, thin green branches/twigs, huge amounts of white cotton-like seeds



### **Mexican Palo Verde – *Parkinsonia aculeata***

**AKA** Jerusalem thorn, horse bean

Slender green photosynthetic zigzag branches armed with sharp spines. Long leaves with a short, spinetipped stalk, leaf branches 8 -16 in. long, flattened, with small, oblong leaflets along each

edge when young. Flowers yellow, fragrant, five petalled, each on a long, slender drooping stalk. Seeds oval, hard, about 3 inches long, borne in pencil-like pods 2 to 4 in. long, constricted between the seeds.

**Key features:** long pine needle-like leaves, set of three thorns on branches, center thorn longer than the two on the side: orange petal in yellow flower.



Cannot be topped for control, must be removed to 1' below soil surface. Topped stumps will re-grow as a dense cluster of branches.



## **Beneficial species**

### **Arizona (Velvet) Ash – *Fraxinus velutina***

Deciduous, medium to large rounded tree 30-50ft high with spread usually 2/3 height. Leaves are pinnately compound, usually 3-5 leaflets per leaf, leaflets 3/4 to 2.5 inches long; upper surface glossy green, lower soft and velvety; fall color yellow or attractive gold. New growth (twigs) are velvety; attractive medium gray trunk, bark fissured throughout.

**Key features:** sharp pointed seed shape, velvet on new branches



**Arizona Sycamore (rare) – *Platanus wrightii***

Tree reaching very large proportions, to 70 feet tall and a crown spread of 72 feet. Leaves are hand shaped and can be up to 12 inches across. Young leaves are velvety, Whitish bark peels off in patches giving the trunk a distinctive light-colored, mottled appearance.

**Key features:** strictly riparian, peeling bark, large hand-like leaf shape, ball shaped seed bundles



**Arizona Walnut (rare) – *Juglans major***

A small tree up to 50 feet in height, trunk often forked with a wide spreading crown. Alternate, pinnately compound with 9 to 15 leaflets, 7 to 13 inches long, leaflets are narrowly ovate to lanceolate, somewhat curved, serrated margins, each 2 to 4 inches long, yellow-green above, paler below. Round nut, 1 to 1 1/2 inches in diameter; husk is thin and initially bright green but turning brown; nut is grooved, maturing in fall.

**Key features:** crushed leaf smells like walnut husk, seed shape



**Blue Palo Verde – Parkinsonia (Cercidium) floridum**

Blue palo verde is a drought-deciduous tree, up to 30 feet tall, with a short trunk; and smooth bluish-green bark. It normally is leafless, or it temporarily has two or three pairs of four leaflets form a single, compound leaf, 0.4 to 0.8 inch long.

**Key features:** Yellow only flower, bluish tinge to bark, leaves ten to be rounder and larger than the Foothills Palo Verde (AKA little leaf Palo Verde),



**Catclaw (Greggs catclaw, devis’s claw, paradise flower, wait-a-minute tree) Acacia – Acacia greggii**

Large shrub or gnarled small tree; multi-stemmed, 10-15ft, spread to 25ft, deciduous, typical legume pod, flat 1-3in long, 1/2in wide, reddish or brown, curls when dry. Claw like thorns.

**Key features:** cat claw like thorns.





### **Desert Willow – *Chilopsis linearis***

Along desert washes that have a reliable underground water source this tree can attain a height of 20 feet or more. The drooping branches and leaves give a willowlike appearance. Flowers are purple and pink tinged trumpets about 1.6 inches long. Simple leaves, 4 inches long, strap-shaped, thickened and leathery. They have a shiny resin surface. A long (6 inches) narrow pod packed with cottony seeds.

**Key features:** long seed pod, trumpet shaped flowers, long leaves, drooping appearance.



### **Desert Hackberry – *Celtis pallida***

**AKA** Spiny hackberry, Granjeno, Granjenillo, Acebuche

A medium-sized shrub from 4 to 15 feet tall. It has smooth gray branches that are strongly zig-zagged and armed with various sizes of thorns. The leaves are 1/2 to 2 1/4 inches long and 1/2 to 1 inch wide. Mostly evergreen, but will drop leaves in a drought or heavy freeze. The greenish-white flowers bloom in the spring. The small, round fruits are yellow to orange in color. Common along washes especially with increasing elevation and available moisture. Absent from the lowest, driest areas of the Sonoran Desert.

**Key features:** zig-zag branches with thorns, orange berries, dark green leaves, dense growth



**Foothills Palo Verde – *Cercidium microphyllum***

**AKA** Yellow Palo Verde, Little leaf Palo Verde, Green Stick

A bristling, upright-branching tree, may rarely grow to heights of 25 to 30 feet (though 10 to 15 feet is more typical). Leaves are yellowish green, to 3/4" long; each leaf has one pair of major leaflets and 5 to 7 pairs of minor leaflets.

**Key features:** white petal in the flower, small leaf sets, light green bark on younger growth



**Freemont Cottonwood – *Populus fremontii***

trees grow to giant proportions. The deeply furrowed bark is light brown or grey. Found throughout the Sonoran Desert wherever there is a continuous supply of water. Frequent at springs, in deep, narrow canyons, along irrigation ditches, and along rivers. Flattened petioles

allow the large leaves to flutter with the slightest breeze, which provides cooling for the leaves during hot weather.

**Key features:** leaf shape, coarse bark on large trees, always near water



### **Gooding Willow (rare) – *Salix gooddingi***

deciduous, dioecious, native shrub or tree, attains a height of 20 to 60 feet, leaves are 2 to 4 inches long; female catkins are 1.5 to 3.2 inches long. Fruits are capsular. The bark of Gooding willow is thick, rough, and deeply furrowed. Riparian occurrence.

**Key features:** classic willow form



### **Ironwood Tree – *Olneya tesota***

An important and sometimes large tree to 40' tall, the bark of young branches is light to dark gray; older bark is dark gray and deeply fissured. Upper lateral branches often arch downwards nearly reaching the ground level. Sharp and slightly curved spines occur in pairs at each node, a profusion of lilac-purple flowers in May.

**Key features:** short thorns on branches, lilac flowers in spring,



**Mexican Elderberry (rare) – *Sambucus mexicana***  
 a semi-evergreen small tree, reaching up to 30 feet in height

**Key features:**



**Netleaf (Canyon , orWestern) Hackberry – *Celtis reticulata***  
 Deciduous; may retain leaves year round in Tucson. Twisted branching habit, "looks like a tangled mess" when young; stems and branches are contorted, growing in all directions; gray bark has distinctive nubby nodules.. Leaves are simple; rough-textured, 2.5.in long; surface like coarse sandpaper, especially on the conspicuous "net-like" raised veins on the underside; top dark green, lighter underneath. Pea-sized berries; green, turning orange/red by late summer or fall.

**Key features:** knobby nodules bark, prominent vein or net texture on leaves



**Screwbean Mesquite – *Prosopis pubescens***

A thicket forming small tree to large shrub (up to 20 feet), typically with several crooked and arching stems forming a broad round crown. Alternate, bipinnately compound leaves, 1 to 2 inches long, usually with only two major leaflets (may occasionally have 2 to 3 pairs), each leaflet with 6 to 9 pairs of narrow minor leaflets (1/2 to 1 inch long) with entire margins and a fuzzy surface, green to gray-green above, paler below. Stems are light reddish brown, slightly zigzag with obvious paired slender spines (up to 1 inch long) at the base of each leaf, spine is nearly white, knobby spur branches may also be present.

**Key features:** spiral seed shape, 2-small white thorns at branch nodes.



**Seep willow (Mule’s Fat, water-wally) – *Baccharis saliciflora***

Dioecious shrub to 10 feet, leaves alternate, 1.6 to 3.2 inches, usually toothed with 1 prominent midvein, petioles winged;

**Key features:**



**Texas Honey Mesquite – *Prosopis juliflora* var *glandulosa***

Medium to small tree with rounded crown and crooked, drooping branches; feathery foliage; straight paired spines on twigs. . Deciduous, up to 30 feet tall, 20 feet spread, tree is covered with fluffy yellowish flowers in spring, seed pods are up to 10-12 inches long, constricted between the seeds.

**Key featurea:**



**Tree tobacco – *Nicotiana glauca***

3 to 12 ft. A short-lived tree with little wood, often produces new shoots from underground runners. Large leaves with glaucous (smooth) and waxy texture. The leaves contain high concentration of nicotine.

**Key features:** thick tough grayish green leaves, yellow trumpet shaped flowers



**Velvet Mesquite (common mesquite, Arizona Mesquite)– *Prosopis velutina***

Deciduous thorny shrub or small tree, 25 to 50 feet tall, 15 to 25 feet wide; mature bark is thick, rough, dark brown, shredding in strips, while the bark on young stem is green, helping in photosynthesis; stout, yellow thorns, 0.24 to 1 inch long; bipinnate leaves with one pair of pinnae bearing 14 to 30 pairs of dark green, short, hairy, and closely spaced leaflets, 0.32 to 0.5 inch long.

**Key features:**



**Western Soap Berry (rare) – *Sapindus drummondii***

A small tree often growing in copses, bark of young branches is pale gray, older bark is darker gray or brown and is fissured. Pinnately compound leaves with an odd number of 7 to 17 leaflets. The leaves are alternate on the stem (ashes have similar leaves but are opposite on the stem). Panicles of numerous, small, white flowers appear in May. Unique fruit is a glassy, golden sphere with a very hard seed inside.

**Key features:** Chinaberry tree like seeds and bark



**White Thorn Acacia – *Acacia constricta***

Large shrub or small tree up to 10 ft high, bark reddish-maroon (making it fairly easy to pick out even at a distance) to gray. Leaves are bipinnately compound. Spines long, straight, and white (on new growth) or absent (on old branches). Flowers bright yellow, forming into 0.5" fuzballs. Without thorns, use the leaves (small, bipinnately compound leaves) and bark color (maroon) to identify.

**Key features:**





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## **Appendix C**

Some watercourses in Tucson are covered by floodplain mapping that used specific channel roughness values. Maintaining the channel to match those channel roughness values is important to public safety. When performing watercourse maintenance on a channel that has a published floodplain (from an entity such as the Federal Emergency Management Agency (FEMA)) use this appendix to gage if vegetation thinning is necessary.

How to use this appendix:

Go to: <http://dot.tucsonaz.gov/mapcenter/>

Click on “Hydrologic Data and Wash Info (requires the Map Guide plug in which is free, just follow the installation directions from the pull-down menu at the center of the page).

Move to or zoom into the section/reach of the watercourse to be maintained.

Click in the box next to “Watercourses” under the “ENVIRONMENTAL/WATERCOURSE INFO” CATEGORY.

Find the section of watercourse to be maintained and hold the cursor over that section. A pop-up box will appear that has properties of the watercourse reach. The nch value is the roughness value for the channel. If nch has no value, simply use the maintenance guidelines and consult the Conservation Office (OCSD) before proceeding.

Next, standing in the flow area of the channel find the image that most closely matches the appearance of the channel to be maintained (has not been trimmed yet). Note the associated roughness value next to the image.

If the roughness value for this image is equal to or smaller than the nch value, no vegetation maintenance is needed.

If the roughness value for this image is higher than the nch value, trimming of vegetation is needed. Locate a channel image with a roughness value equal to the nch value. This image is a visual approximation of what the channel should look like after maintenance activities. REMEMBER, if there will be more trimming the is considered “routine maintenance” consultation with the Conservation Office (OCSD) is required before proceeding.

Thanks to the following for providing roughness value input for the following images: Pima County Regional Flood Control District, City of Tucson, Arroyo Engineering, J E Fuller Hydrology and Geomorphology, and Tetra Tech Inc.

Channel Roughness = 0.035



Clean earthen channel and banks, no ground cover, few trees, smooth banks

Channel Roughness = 0.035



Earthen channel with low to moderate bank vegetation, few trees

Channel Roughness = 0.035



Clean sandy flow area and banks, moderately rough (indentations) banks

Channel Roughness = 0.040



Clean sandy flow area, moderate bank vegetation, moderate tree density  
Channel Roughness = 0.040



Clean sandy flow area, vegetated banks, moderately rough (indentations) banks

Channel Roughness = 0.040



Clean sandy flow area, moderate bank vegetation, moderately rough (indentations) banks

Channel Roughness = 0.045



Clean sandy flow area, vegetated banks, slightly rough (indentations) banks

Channel Roughness = 0.050



Rocky flow area, moderately dense bank vegetation, trees in banks, rough banks

Channel Roughness = 0.050



Clean sandy flow area, dense vegetation on banks

Channel Roughness = 0.050



Rough flow area, rough banks, moderately dense vegetation  
Channel Roughness = 0.050



Rough flow area, rough banks, moderately dense vegetation

**Sheet flow watercourses**

Channel Roughness = 0.050



100-year sheet flow 2' deep

Channel Roughness = 0.060



100-year sheet flow 2' deep

Channel Roughness = 0.065



100-year sheet flow 2' deep

Channel Roughness = 0.10



100-year sheet flow 2' deep, stiff grasses to 1' high

Channel Roughness = 0.10



100-year sheet flow 2' deep, stiff grasses to 1' high

# Appendix D

Use of herbicides in watercourses within the City of Tucson are regulated under the Clean Water Act. The Clean Water Act regulations are enforced locally under the City of Tucson's Stormwater Permit from the Arizona Department of Environmental Quality.

The only herbicide approved for use in and/or near a watercourse in the City is Rodeo. Please use the procedure outlined in the following policy statement when performing maintenance on a watercourse that may involve herbicide application.

## Policy

The Stormwater Section has reviewed the MSDS for the herbicide Rodeo. The label identifies the product for aquatic weed and brush control. However, the City's Municipal Stormwater Permit "Chapter 4.2.1.2.3, **Vegetation Control and Removal in Open Channels**" is more restrictive and states "*Herbicides approved by the EPA for use in drainageways will be used in rare and specific cases, and only when no other alternative exists.*" As long as the product is used according to the manufacturer's recommendations, the Stormwater Management Section has no objection to its use in the drainage ways. If Rodeo or any other herbicide is used in the drainage ways, the location, amount of product used and the dates must be documented and reported to the Stormwater Section.

Please make sure that the maintenance entity abides by the following guidelines:

1. Do not use where physical removal of weeds is a practicable alternative.
2. Do not apply in any areas where ponding water or saturated soil is nearby.
3. Do not use in a way that involves general application over a broad expanse of ground.
4. Use spot application with backpack sprayer or use brushed-on application.
5. Do not apply when 5-day forecast shows likely precipitation. Do not apply during rainy season.
6. Follow all directions on the label.
7. Check with the Stormwater Section for specific site approval for any application consisting of more than 5 gallons in a drainage way.